

## WATER QUALITY CONCERNS AND STATUS

### Water Quality-limited Waters

In 1998, DEQ established a new 303(d) list based on assessments performed through the Beneficial Use Reconnaissance Project (BURP) and other pertinent material regarding beneficial use status and water quality standards violations. The 1998 303(d) list included eleven (11) water body segments in the Upper Salmon subbasin (Figure 7 and Table 3). The EPA approved that list in May 2000, but has proposed to add to the list for the Upper Salmon subbasin one water body (Squaw Creek) listed for temperature pollution. Figure 7, which is an official 303d GIS coverage, depicts Garden Creek as a U-shaped stream. The eastern half of that U-shape appears to be in error as that is part of a canal system coming off the Salmon River. On topographic maps, Garden Creek appears to terminate at Hanna Slough and does not directly intercept the Salmon River.

**Table 3. 1998 303(d) listed stream segments for the Upper Salmon (17060201) subbasin.**

Stream	Boundaries	Stream Miles	Pollutant(s)
Salmon River	Redfish Lake Creek to East Fork Salmon River	44.45	Sediment, temperature
Salmon River	Hellroaring Creek to Redfish Lake Creek	13.34	Sediment
Challis Creek	Forest boundary to Salmon River	9.35	Sediment, nutrient, flow alteration
Garden Creek	Forest boundary to Salmon R.	14.39	Sediment, nutrient
Warm Spring Cr.	Headwaters to sink	21.56	Sediment, nutrient
Thompson Creek	Scheelite Jim mill to Salmon R.	1.02	Sediment, metals
Yankee Fork	Jordan Creek to Salmon River	9.0	Sediment, habitat alteration
Yankee Fork	4 <sup>th</sup> of July Creek to Jordan Creek	2.92	Sediment, habitat alteration
Lost Creek	Headwaters to sink	4.45	Unknown
Kinnikinic Creek	Sawmill Cr. to Salmon R.	2.99	Unknown
Road Creek	Headwaters to EF Salmon R.	15.77	Unknown
Added by EPA, January 2001			
Squaw Creek	Headwaters to mouth	unknown	Temperature



## Water Quality Standards

Water Quality Standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect these beneficial uses include narrative criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria which vary according to beneficial uses (IDAPA 58.01.02.250, 251, & 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life (e.g. pH, temperature, dissolved oxygen (DO), ammonia, toxics, etc), and toxics and turbidity criteria for water supplies. Idaho's water quality standards are published in the state's rules at *IDAPA 58.01.02 B Water Quality Standards and Wastewater Treatment Requirements*. Designated beneficial uses for waters in the Upper Salmon subbasin are listed in Table 4.

**Table 4. Waters with designated beneficial uses in the Idaho Water Quality Standards.**

Map Code	Water Body	Designated Uses
S-1, S-14, S-16, S-19, S-26, S-28, S-44, S-60, S-65, S-69, S-70, S-78	Salmon River – 12 water body units from Pahsimeroi River to the Salmon River's source	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water
S-21, S-23	Squaw Creek – two water body units from mouth to confluence of Aspen and Cinnabar Creeks	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
S-27	Thompson Creek – mouth to source	Cold Water Biota, Salmonid Spawning, Secondary Contact Recreation
S-29, S-31	Yankee Fork – two water body units from mouth to source	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water
S-99, S-100, S-107	East Fork Salmon River – three water body units from mouth to confluence of South and West Forks of Salmon River	Domestic Water Supply, Cold Water Biota, Salmonid Spawning, Primary Contact Recreation, Special Resource Water

Waters not specifically designated in the Idaho water quality standards are Undesignated Waters (IDAPA 58.01.02.101), which are generally protected for Cold Water aquatic life use and Primary or Secondary Contact Recreation until designated. Additionally, all waters of the state are designated for Agricultural and Industrial Water Supplies, Wildlife and Aesthetics.

Of particular importance regarding listed water bodies in this subbasin are the criteria for sediment, temperature, nutrients, and metals. The narrative criterion for sediment is as follows:

- Sediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determination of impairment shall be based on water quality monitoring and surveillance and the information utilized in Section 350.02.b. @

Quantities specified in Section 250 refer to turbidity criteria identified for cold water biota use and small public domestic water supplies. Turbidity must be measured upstream and downstream from a sediment input in order to determine violation of criteria. The quantitative criterion for turbidity is as follows:

- “Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days.

Indirectly, specific sediment criteria also include intergravel dissolved oxygen measures for salmonid spawning uses. Intergravels filled with sediment can't hold enough dissolved oxygen for successful incubation. Intergravel dissolved oxygen measurement requires the placement of special apparatus in spawning gravels. Turbidity and intergravel DO are rarely measured as part of routine reconnaissance-level monitoring and assessment. These measurements are usually conducted in special cases during higher-level investigations of potential problems. Because of access difficulty, such techniques are rarely used in the back-country settings comprising most of this subbasin. The quantitative criterion for intergravel dissolved oxygen are as follows:

- “(a) One (1) day minimum of not less than five point zero (5.0) mg/l. (b) Seven (7) day average mean of not less than six point zero (6.0) mg/l.

Because of the lack of specific numerical criteria for sediment, surrogate measures are often used as a mechanism to reflect potential sediment problems. Often the percentage of depth fine sediments found in spawning gravels is used as an indicator of sediment problems that will affect salmonid species. Generally, depth fines greater than 28% are considered unhealthful for spawning gravels. Bank stability can be another indicator of sediment problems in streams. When bank stability falls below 80%, these banks may be contributing unhealthy levels of sediment to aquatic habitats. There are other surrogate measures for sediment, however, caution is advised as specific levels can be highly variable depending on stream morphology and geology of the area, and it may be difficult to pinpoint levels that are universally acceptable.

The narrative criterion for Nutrients is as follows:

- **Excess Nutrients.** Surface Waters of the State shall be free from excess nutrients that can cause visible slime growth or other nuisance aquatic growths impairing designated beneficial uses.

The measures for excess nutrients that are often examined are total nitrogen (TN), total phosphorus (TP), chlorophyll-a, and turbidity. Although there is no maximum level specified by law, it is often recommended that total phosphorus as phosphorus should not exceed 50 micrograms per liter (ug/l) at the point where the stream enters a lake or reservoir, nor 25 ug/l within the lake or reservoir (EPA Goldbook, 1986). The desired goal associated with these limits is to prevent eutrophication or nuisance algal growths in the waterbody. In some cases where phosphorus is not the limiting nutrient, total nitrogen values may give an indication of overall nutrient enrichment. Chlorophyll-a and turbidity measures relate to how much algae growth is occurring and causing cloudiness in the water.

Arsenic and copper are examples of metals of concern in this subbasin. Below are the criteria for these two metals. Other metals criteria are similarly derived.

- The numeric criteria for arsenic are incorporated into the state's standards by reference from 40CFR131.36, as 360 ug/l for acute toxicity and 190 ug/l for chronic exposure, both expressed as dissolved concentrations. If dissolved (0.45 micron filtered) arsenic levels in the surface water exceed the 190 ug/l standard, the stream may be in violation of the required standard.
- The numeric criteria for copper are also incorporated by reference from 40CFR131.36, and presented as an equation based on stream water hardness. The acute criterion is:

$$(0.96)e^{(0.9422(\ln H)-1.464)}$$

and the chronic criterion equation is:

$$(0.96)e^{(0.8545(\ln H)-1.465)}$$

where  $\ln H$  equals the natural log of the surface water's hardness. The hardness of the waterbody is measured as milligrams of  $\text{CaCO}_3$  and put into the equation for H. The standard for copper is calculated based on the hardness number entered and is expressed as a dissolved concentration. If dissolved (0.45 micron filtered) copper levels in the surface water exceed the calculated standard, the stream may be in violation of the required standard.

- **Hydrogen Ion Concentration (pH) criteria** (IDAPA 58.01.02.250) states that values must be within the range of six point five (6.5) to nine point zero (9.0).

- Narrative criteria (IDAPA 58.01.02.200) that might also apply to metals include hazardous materials (01.), toxic substances (02.), deleterious materials (03.), and floating, suspended or submerged matter (05.).

The criteria for temperature are dependent upon the aquatic life residing in the waters in question. For the waters in this subbasin, temperature criteria for cold water aquatic life, salmonid spawning, and bull trout spawning and rearing are likely to apply.

The temperature criteria (values not to be exceeded) for cold water use are:

- 22°C as a daily maximum and 19°C as a daily average.

The temperature criteria for salmonid spawning use are:

- 13°C as a daily maximum and 9°C as a daily average.

These criteria apply to waters where salmonid spawning occurs, and only during the time periods when the particular species of salmonids inhabiting the waters normally spawn. Critical periods for spawning are typically September and October for fall spawners and May and June for spring spawners.

The state temperature criteria for bull trout spawning and rearing are:

- 13°C as a Maximum Weekly Mean Temperature during June, July and August for juvenile bull trout rearing, and
- 9°C as a Maximum Daily Mean Temperature during September and October for bull trout spawning.

These criteria apply to all tributary waters, not 5<sup>th</sup> order mainstem rivers, above 1400 meters (4593 feet) elevation in the bull trout key watersheds in the Salmon River basin. Additionally, the federal (EPA) criterion for bull trout is 10°C as a seven-day moving average of the daily maximum water temperatures. Biological assessments produced by BLM, Challis Resource Area and the Salmon-Challis National Forest indicate that critical water temperatures for bull trout require that spawning temperatures be reached sometime during the September-October spawning window for bull trout, and that summer time rearing temperatures stay below a maximum of 15°C (BLM, 1999a; USDA FS, 1999a; USDA FS 1999b).

## **Water Body Assessments**

Many waters in the Upper Salmon subbasin have been monitored through the Beneficial Use Reconnaissance Project (BURP) process (see Appendix A for list of BURP sites). Some streams have been monitored in more than one location and in more than one year. Data gathered prior to 1997 were used in the assessment of beneficial use status for the 1998 303(d) list. Data from those sites sampled in 1997 and later have not been used to

determine the status of beneficial uses of these waters. Below are the macroinvertebrate biotic index (MBI) scores, a primary tool for assessing aquatic life use status, for the 303d listed waters in this subbasin. In general, MBI scores are considered adequate if they exceed 3.5, and are poor if they are below 2.5. MBI scores between 3.5 and 2.5 are marginal and referred to as in “need of verification.” Adequate habitat scores vary depending on the ecoregion the site is located in, but generally should be greater than 70.

### **Garden Creek**

Two of the five BURP sampling efforts on Garden Creek resulted in low MBI scores (Table 5). The first site was a headwaters location with very low flow, probably an intermittent or ephemeral stream segment. Data collected from streams with flow less than 1 cfs is not used to characterize segments of the stream with regard to beneficial use support. Narrative water quality standards are not applied to waters with less than 1 cfs flow.

The second site was at the low end of Garden Creek just within the city limits of Challis. This site was slightly below the Full Support threshold of 3.5 and received a needs verification assessment status because of low MBI and habitat scores, and because of a reduction in the number of age classes of fish observed at this site. Higher elevation sites had sculpin and multiple age classes of brook and cutthroat trout. The lower elevation site had sculpin and limited numbers of cutthroat trout. Garden Creek was 303(d) listed from the Forest Boundary to its mouth because of this lower site. The majority of this land appears to be in private ownership. The 1993 sites were not assessed due to the lack of information collected and changes in techniques in that first year of BURP.

Based on the above information, the impacted segment of this stream is likely to begin at the Challis city limits. Further investigation shows that Garden Creek is often dewatered within the city limits, and instream habitat is greatly reduced by stream channelization and stream banks that have been armored with riprap adjacent to residences within the city. Garden Creek will be listed for habitat and flow alteration from the City limits downstream to the confluence with the Salmon River as a result of the Subbasin Assessment. A TMDL will not be prepared for Garden Creek to address this perturbation. Flow and habitat alteration are not recognized pollutants.

**Table 5. Garden Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Headwaters above Buster Lake (2609m)	<i>NA</i>	1.91	<i>NA</i>	0.1	1993
Downstream from Buster Lake (2487m)	Full Support CWB, SS	3.59	101	21.7	1995
Below Keystone Gulch (2011m)	Full Support CWB, SS	4.54	96	67	1995
Within Challis city limits (1646m)	Need Verification	3.42	65	62.4	1995
Outside Challis city limits (1597m)	<i>NA</i>	3.64	<i>NA</i>	3.3	1993

**Road Creek**

Road Creek had two low scoring sampling events in 1995 (Table 6). Samples were collected in the upper watershed, near the headwaters and the lower watershed, just above the confluence with the East Fork of the Salmon River. Both of these sites were dry in 1994 and the highest elevation site had flow less than 1 cfs (0.5 cfs) when it was sampled in 1995. Dewatering from irrigation diversions impacts the lower site. The 1998 303(d) listing of Road Creek is based on the 1995 assessments as the 1997 data had not yet been assessed. Sample sites with flow less than 1 cfs are not currently used to characterize water body support status.

There were two high scoring samples in 1997 (Table 6) at middle elevations that experience better flow conditions. These data suggest the upper and lower reaches of the stream may be impacted by low flow conditions in low water years. However, the low elevation site in 1995 had abundant flow, but macroinvertebrate scores were low due to previous extended dewatering.

Further analysis of macroinvertebrates (Clark, 2000) indicated that low scoring sites were impacted by fine sediments, but not temperature (see Appendix F). It is not clear if the interpretation of macroinvertebrate samples collected in reaches that are frequently dewatered mimic interpretation of samples collected in reaches with sediment impacts, but this is likely.

Mid-elevation reaches may be in reasonably good shape when there is sufficient flow, whereas dewatering from irrigation likely impacts low elevation reaches. Site visits in 2000 and 2001 showed that the stream channel was dry well above the lower BURP site (located at 1722 m elevation). The bulk of the water quality issues related to beneficial use support are likely due to dewatering of the stream channel well below Horse Basin Creek. Data collected from streams with flow less than 1 cfs are not used to characterize segments of the stream with regard to beneficial use support and narrative criteria do not apply.

Road Creek supports good populations of Westslope cutthroat and rainbow trout. Multiple age classes of both species have been sampled by BLM (IDEQ 1999a). In a 100 meter transect 12 fish were collected which included 7 salmonids in 4 age classes plus young of the year as well as 5 sculpin in various age classes. Electrofishing conducted by IDEQ in 1998 produced multiple age classes of sculpin as well.

Although, as the name implies, Road Creek is paralleled by a road for almost its entire length, and there may be cumulative effects on downstream reaches, the greatest impacts are from irrigation related dewatering over the lower reaches and the ephemeral nature of the headwaters reach. Observation associated with field data collection shows that riparian areas are in good condition above the private ground near the mouth of Road Creek. BLM has been actively pursuing riparian protection and restoration in this watershed (Kate Forster, BLM, personal communication) through grazing plan improvements and Interagency Implementation Team inspections and monitoring.

A small band of BLM ground separates two private ground sections in the lower reach, just above the confluence with the East Fork Salmon River. This reach has observable head cutting and bank erosion and is very narrow and impinged by the road. The lower BURP site (1722 meters) in 1995 was in this location. This section is not representative of Road Creek above this location. The private ground above this reach is used for irrigated hay production and pasturing of livestock. Diversion structure impacts in this section may be contributing to the headcutting occurring below.

Road Creek will be listed for flow alteration from the upper private land/BLM boundary of this small parcel, downstream to the confluence with the East Fork Salmon River as a result of the Subbasin Assessment. Dewatering occurs from the irrigation diversions above the upper boundary of the small lower parcel of BLM lands that the Creek flows through. This boundary is about 4,800 feet above the confluence with the East Fork of the Salmon River and coincides with the western edge of section 19 at N 44° 11.275' W 114° 16.339'. A TMDL will not be prepared for Road Creek to address this perturbation. Flow and habitat alterations are not recognized pollutants.

**Table 6. Road Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Douglas Springs (2194m)	<i>NA – dry channel</i>			Dry	1994
Below Douglas Springs (2194m)	Not Full Support (CWB)	1.68	60	0.5	1995
Below Bear Creek (1987m)	NA	4.29	<i>NA</i>	1.1	1997
Above Horse Basin Creek (1923m)	NA	4.89	<i>NA</i>	5.1	1997
Above bridge near mouth (1722m)	Not Full Support (CWB)	2.79	99	14.5	1995
Above bridge near mouth (1712m)	<i>NA – dry channel</i>			Dry	1994

**Challis Creek**

Challis Creek received four BURP sampling events from 1993 to 1998 (Table 7). Only one site, at the lowest elevation, produced a low MBI score. Three cutthroat trout and four brook trout representing multiple size classes were collected in upper Challis Creek in June of 1994. Further downstream (above White Valley Creek) 33 sculpin and six rainbow/steelhead trout (one size class) were collected at the same time. The highest elevation site (above Mosquito Flat Reservoir) was sampled in 1998 and data have not been assessed from this site. However, it produced the highest macroinvertebrate score.

The next site downstream below the reservoir sampled in 1995 was assessed as fully supporting aquatic life uses. Also below Mosquito Flat Reservoir was a site sampled in 1993 (above Lodgepole Creek). Data from that site were not used in the 1998 303(d) list assessment, however, its macroinvertebrate score is very comparable to the 1995 site of similar location. The lowest elevation site (above Mill Creek) produced the only low macroinvertebrate score and was assessed as needs verification status. Based on these data, the impacted portion of Challis Creek would appear to be at least from Mill Creek downstream. Although the area of impact may extend upstream to Lodgepole Creek, the 1998 303(d) listing extends upstream to the Forest Boundary just below Pats Creek (about half way between Mill Creek and Lodgepole Creek). Most of this land is in private ownership.

Sampling conducted by Environmental Science & Research Foundation (ESRF) showed McNeil Core sediment sampling of depth fines above 40% (41% and 44% at upper and lower sampling sites respectively). Stream bank erosion rate estimates and road erosion estimates were also made by ESRF. Challis Creek had one slightly eroding reach, three moderately eroding reaches and one severely eroding reach. DEQ supplemented the estimates with additional road and stream bank erosion estimates, based on existing land use, to aid in development of a Total Maximum Daily Load allocation (TMDL) for sediment. The streambank erosion inventory was repeated on the upper reach during

May, 2002 to validate the estimates, and a large landslide below Mosquito Flats Reservoir was identified as a significant sediment source.

There were no indications of deleterious levels of aquatic plants or nuisance levels of algae observed in Challis Creek along inventoried reaches. The sediment load allocation is developed in greater detail in the TMDL section of this document.

Recommendations from the USDA FS Challis Creek Watershed Analysis (USDA FS 1997b) regarding the issue of hydrologic conditions and biotic communities identify the need for further monitoring to establish inventories of systemic base data, presence/absence and macroinvertebrate trends, and causes of channel aggradation over the lower reach of Challis Creek. The analysis states that “No new project activities (e.g., timber sales, road construction) should proceed in the watershed until base level aquatic inventories are completed in that portion of the watershed that would be immediately impacted by the proposed activity.”

Implementation recommended in the analysis focus on reducing the amount of eroded material from the road entering streams by reducing the amount of water flowing down the roads. Recommendations associated with human uses include purchase and installation of appropriate signs that identifying open and closed routes to motorized vehicles to reduce travel plan infractions.

A Total Maximum Daily Load has been developed within this document based on data accumulated through the Subbasin Assessment and the following Field season. The Challis Creek TMDL for sediment should act to further formalize and facilitate additional evaluation of sediment issues on Challis Creek by the USDA FS.

**Table 7. Challis Creek BURP Assessment**

BURP Site	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above Mosquito Flat Reservoir	<i>NA</i>	5.53	<i>NA</i>	6.1	1998
Below Mosquito Flat Reservoir	Full Support (CWB, SS)	3.92	98	48.8	1995
Above Lodgepole Creek	<i>NA</i>	3.89	<i>NA</i>	11	1993
Above Mill Creek	Needs Verification (CWB)	3.17	66	28.8	1995

### **Thompson Creek**

Thompson Creek was sampled in two locations in 1994 and approximately the same locations again in 1995 (Table 8). The downstream location in 1995 produced the only

low MBI score. The upper locations were above the discharge for the Thompson Creek Mine. IDFG collected five cutthroat trout (two age classes), one rainbow/steelhead, and 31 sculpin above the mine discharge in 1994. Below the mine discharge in 1994, IDFG snorkeling data showed young-of-year chinook, three bull trout, and multiple age classes of steelhead.

Although originally proposed for delisting in 1998, as a result of public comment DEQ 303(d) listed a limited portion of Thompson Creek from the Scheelite Mill site to mouth (DEQ, 1998). This area did produce one “needs verification” assessment because of low macroinvertebrate scores. The probable cause of the lower MBI score was identified as the armoring of the substrate due to iron hydroxide coating. However, the 1998 303(d) listing record also indicates that there is no evidence of a declining biological community and chemical data are inconclusive. Sediment and metals sensitive fish were well represented in all surveys. These data suggest that the basis for impairment is the iron hydroxide armoring of the stream substrate. Although there are no specific numeric criteria for iron, the beneficial use impairment may have been caused by hazardous or deleterious materials, or possibly submerged matter defined in narrative criteria.

The USDA FS completed restoration best management practices in 1992 to eliminate the problem with iron hydroxide precipitate deposition at and below the Scheelite Jim Mill site. Tailings reclamation included the installation of an earthen cap on the Mill Site and contouring the tailings to drain into a series of constructed wetland buffer ponds above the stream. The wetland ponds were isolated from Thompson Creek with an earthen berm. This reclamation activity has eliminated iron hydroxide discharge into the stream below the Mill site. Deposited iron hydroxide is being removed through natural bedload transport.

The USDA FS has stated that they have conducted monitoring that shows steady improvement in macroinvertebrate diversity and abundance since the flushing flows of spring runoff that were experienced in 1997 and 1998 (Marvin Granroth, USDA FS 2001, Personal Communication). A site evaluation conducted by DEQ with the USDA FS in October of 2001 affirmed the elimination of iron hydroxide deposition below the reclaimed mill site. Only slight deposition remains over several feet of the near stream bank adjacent to the lower pond (pond #7), and that is expected to further diminish as the wetland buffer becomes more established and matures. Monitoring by the Challis Ranger District of the Forest Service has shown that monthly instantaneous stream temperature related to cold water use (excluding salmonid spawning), and pH are within water quality criteria above and below the mill site (Table 9) (USDA FS 2002). Forest service water temperature monitoring was not adequate to interpret daily or weekly averages to evaluate salmonid spawning temperature criteria compliance. Full implementation of the appropriate best management practices prior to 303(d) listing of the limited reach of Thompson Creek precludes the need for development of a TMDL for Thompson Creek for metals or sediment. Particularly since upstream sites show strong full support of beneficial uses. Continuing BURP and USDA FS monitoring will be conducted to follow water quality and beneficial use support.

**Table 8. Thompson Creek BURP Assessment**

BURP Site	Assessment	MBI Score	Habitat	Flow (cfs)	Year
Above Basin Creek (2145m)	Full Support (CWB, SS)	4.98	99	0.6	1994
Above Basin Creek (2145m)	Full Support (CWB, SS)	5.12	104	2.2	1995
Near mouth (1719m)	Needs Verification	3.35	80	7.7	1995
Near mouth (1694m)	Full Support (CWB, SS)	4.44	89	2.1	1994

The USEPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance Memorandum (EPA 2001) describes the requirements for states reporting to EPA the water quality standard attainment status of Assessment Units of water bodies. Each Assessment Unit should be placed in only one of five unique assessment categories. Monitoring required to validate water quality management strategies for assessment units is conducted at appropriate intervals for each category. The categories are: 1) Attaining the water quality standard and no [beneficial] use is threatened; 2) Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. 3) Insufficient or no data and information to determine if any designated use is attained. 4) Impaired or threatened for one or more designated uses but does not require the development of a TMDL: a) TMDL has been Completed or b) Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. 5) Beneficial uses are limited and a TMDL is Required. The listed reach of Thompson Creek falls under category 4.b of this guidance. Implementation of Best Management Practices are complete, and as wetland vegetation in the ponds mature water, water quality will improve. Monitoring will be on-going by USDA FS.

**Table 9. Thompson Creek monitoring results at Scheelite Jim Mill site**

Site 1: 200 ft below wetlands			Site 2: 60 ft below wetlands		Site 3: yellow boy Area		Site 5: 300 ft above wetlands	
Date	pH	Conductivity	pH	Conductivity	pH	Conductivity	pH	Conductivity
1/3/90	7.8				6.8		8.2	
2/15/90	8.3				7.0		8.4	
4/3/90	8.3				7.3		7.7	
8/6/90	7.3				6.7		8.3	
4/25/94	7.5				6.9		7.6	
7/26/94	8.2				7.4		8.5	
10/7/94	7.1		7.2		7.1		7.2	
12/2/94	7.92		7.8		7.9		8.16	
12/30/94	7.63		7.76		8.05		8.08	
1/27/95	7.81		7.94		7.61		8.0	
2/28/95	7.85		7.59		7.6		7.98	
4/4/95	8.15		7.83		8.21		8.39	
4/28/95	7.96		7.86		8.04		8.34	
5/31/95	7.5		7.47		7.39		7.71	
6/30/95	7.25	46.1	7.13		7.24	45.4	7.47	33.8
7/31/95	7.69	44.7	7.4		7.86	34.6	8.0	27
9/7/95	7.75	43	7.71	44	7.65	49.5	8.04	26.3
9/29/95	8.39	159	8.33	182	8.44	132	8.58	78
10/31/95	8.13	40	8.17	38	8.34	29.3	8.33	29.8
11/30/95	7.37	83.7	7.35	83.1	7.55	73.3	8.18	41.6
1/9/96	7.61	72	7.61	72	7.8	61.6	7.97	52.6
1/31/96	7.27		6.99	102.7	7.47	79.3	8.11	46.3
2/29/96	7.74	75	7.64	82.1	7.92	65.2	8.12	56.4
4/1/96	7.74	74.3	7.55	85.4	7.88	66.4	8.1	54.7
5/1/96	7.96	57.9	8.01	56.6	8.09	51.1	8.2	45
5/31/96	7.57	79.4	7.63	77.5	7.61	77.8	7.93	60.9
7/2/96	7.68	72.4	7.65	74.3	7.62	75.9	7.84	63.1
8/2/96	8.2	50.3	8.16	52	8.17	51.1	8.41	39.8
8/30/96	8.52	33.7	8.44	38.1	8.1	30.6	8.67	25.6
10/1/96	7.93	55.6	7.78	64.7	8.11	49.5	8.42	29.8
10/31/96	7.76		7.66		8.11		8.2	
12/2/96	7.76	67.5	7.78	67.3	7.78	65.5	7.97	54.8
1/2/97	7.62	75.9	7.65	73.7	7.74	68.2	7.99	55.4
2/3/97	7.87	63.4	7.89	63.1	8.02	55.4	8.3	40.8
3/3/97	7.83	62.2	7.55	77.3	7.98	53.6	8.14	48.5
4/1/97	7.65	76.1	7.53	83.1	7.67	75.4	8.13	51.1
5/7/97	7.8	60.9	7.78	62.1	7.77	62.8	8.05	47.7
6/2/97	7.39		7.26	92.9	7.53	77.3	7.78	63.3
7/3/97	7.6	67.6	7.43	75.2	7.39	77.2	8.16	34.6
8/1/97	7.93	53.5	7.81	61.3	7.48	76.6	8.28	35.1
9/3/97	7.57	67.8	7.42	76.2	7.53	124.4	8.29	27.6
10/10/97	7.37	71	7.33	73.7	7.68	60.2	8.1	59.1
11/4/97	7.64	63.4	7.5	69.4	7.6	91.5	8.21	32.3
12/11/97	7.7	61.7	7.78		7.58	70.4	8.28	32.2
2/5/98	8.5	150	8.46	160		240	8.82	160
3/13/98	7.3		7.21		6.83		7.32	
4/16/98	8.7	260	8.62	280	6.77	320	8.8	270
5/15/98	7.9	260	7.7	260	7.57	100	8.11	270
6/24/98	8.0		8.5		7.74		8.14	
5/1/99	7.4		7.43				7.52	
5/18/99	7.4	150	7.37			90	7.52	275
5/10/00	8.0				7.96		8.2	
5/25/01	7.7	290	8.4	130	6.24	240	7.76	130
8/29/01	7.4	260	7.1	320	6.8	340	8.11	310

### **Warm Spring Creek**

The DEQ water body assessment shows that the source of Warm Spring Creek is natural Hot Springs. This condition precludes attainment of cold water biota criteria throughout the year. The perennial portion of the stream flows approximately 100 yards in its natural channel before it is diverted in its entirety into an aquaculture facility, which has raised tilapia and other tropical warm water fish. The effluent from the hatchery then flows into a ditch that follows the elevation contour at its diversion to supply a hydroelectric project several miles away. Outflow from the hydroelectric project continues in a ditch system that does not return water to the natural stream channel. The natural stream channel remains dry throughout the year. Historically flow in Warm Spring Creek naturally infiltrated prior to reaching the Salmon River.

The low macroinvertebrate scores obtained in 1995 at the streams source and from the diversion ditch resulted in the stream being 303d listed (Table 10). However, caution should be used in determining that aquatic life use and consequently support is appropriate for geothermal water in a manmade diversion. At the time of assessment, fish data were not available and it was assumed that the stream was unlikely to support salmonids in the absence of water. The dewatered natural stream channel, located several hundred meters to the east, is heavily impacted by previous seismic events that resulted in severe downcutting prior to complete dewatering throughout the year.

Water flows only in a manmade channel to provide water to a hydroelectric project and then the water is consumed by irrigation. There is no flow in the natural channel.

- The Ditch does not flow into an identifiable water of the U.S. and there is not a listed stream segment as its receiving water.
- The ditch has not been identified as a point source of a particular pollutant that is discharged into an identifiable water of the U.S. or the state.

Combined with the known geothermal source of this stream and the fact that the flow is isolated from other full support or 303(d) listed water bodies there will not be a TMDL developed for this system.

Narrative water quality criteria are generally assessed by determining if aquatic life uses are supported. In the case of aquatic life, multimetric indexes for macroinvertebrates, fish, or algae have been developed to determine aquatic life use support (Grafe et al. 2002). However, multimetric biological indexes such as the SMI are not appropriate to apply to intermittent [or dewatered] streams. This is because these indexes were developed based on community composition and function typical of an expected reference condition. Reference conditions are persistent aquatic habitats that allow full development of aquatic communities. Temporary waters will never have similar composition and function as perennial waters (Grafe et al. 2002, IDEQ 1999b). Therefore SMI scores are not used to assess aquatic life uses on Warm Spring Creek.

In the case of intermittent waters, numeric criteria apply only at times above “optimal” flows of >1cfs (WQS §70). Warm Spring Creek is listed for nutrients and sediment;

neither of which have numeric criteria. Delisting of the stream is recommended since pollutants are not the limiting factor for aquatic life uses.

**Table 10. Warm Spring Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
North of Grand View Canyon (1748m) At Source	Not Fully Supporting (aquatic life)	2.0	52	1.6	1995
Below Ingrams Pond (1618m) In Ditch	Not Fully Supporting (aquatic life)	2.76	76	3.5	1995

### **Yankee Fork**

All four sampling events on the Yankee Fork produced high MBI scores suggesting that at elevations above 1922 meters cold water biota use is fully supported (Table 11). The upper Yankee Fork fish surveys produced bull trout (two year classes), cutthroat trout (three year classes), numerous young-of-year chinook, steelhead, mountain whitefish, and mottled sculpin. Below Jordan Creek, only mountain whitefish and mottled sculpin were collected.

Dredge mining has severely altered riparian and instream habitat and historically has increased sediment load in this section below Jordan Creek. Numerous projects have been underway since the late 1980's to restore habitat and stream channel characteristics. McNeil sediment core depth fines sampling in spawning habitat has shown significant decreases in two of 5 sites sampled, one site remained static, and two sites had significant increases over a five year period. The two increasing sites, however, averaged 22 % and 17% fines depth less than 6.35 mm, which is well below the target level of 28% set by DEQ for streams requiring restoration of salmonid spawning. The maximum observed fines during the period 1995 through 1999 at the two sites identified as having increased depth fines was 29.1 and 29.5 % fines less than 6.35 mm. These values are close to target values for subsurface fine sediment, and are within the range of standard error for the target.

High macroinvertebrate scores and salmonid populations indicate that water quality supports beneficial uses. Low habitat scores indicate that habitat is compromised as a result of large scale dredge mining.

The major tributary on the listed reach of the Yankee Fork of the Salmon River is Jordan Creek. BURP Sampling shows that Jordan Creek is in full support of coldwater biota and salmonid spawning. Jordan Creek is not on the §303(d) list of impaired water bodies (Table 12). As mentioned earlier there is an Administrative Order of Consent between EPA and the USDA FS to eliminate water quality impacts to Jordan Creek from leaking tailings ponds and mine discharge. Plans are in development to control the discharge of cyanide. Monitoring for pH has been conducted in Jordan Creek and the data does not

indicate that the water quality criteria are significantly exceeded. Sample dates that show exceedances accrue less than 4% of samples (Table 13).

As a result the Yankee Fork will be listed solely for Habitat Alteration and will continue to be monitored for changes in beneficial use support. A TMDL for sediment is not warranted at this time for the Yankee Fork.

**Table 11. Yankee Fork BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above McKay Creek (2280m)	<i>NA</i>	4.91	<i>NA</i>	21.1	1998
Below McKay Creek (2255m)	Full Support (CWB, SS)	4.88	92	20.2	1995
Below Adair Creek (1962m)	Not Fully Supporting (SS)*	5.65	52	61.4	1995
Below Bonanza (1922m)	Nt Fully Supporting (SS)*	5.61	56	58.8	1995

**Table 12. Jordan Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
½ mile above Condlurence with Yankee Fork (1969m)	Full Support (CWB SS)	4.76	75	79.37	1995
1.2 miles above mine turnoff (2275m)	Full Support (CWB SS)	5.75	103	41.75	1995

**Table 13. Jordan Creek monitoring data at North Access Bridge**

<b>Sample Date</b>	pH, Lab (SU)	pH, Field (SU)	<b>Sample Date</b>	pH, Lab (SU)	pH, Field (SU)
3/29/99	6.6	7.95	3/5/01		7.4
5/13/99	7.37	8.1	3/12/01		7.5
6/2/99		7.9	3/19/01		7.4
5/5/00	<b>5.3</b>	<b>5.22</b>	3/26/01		7.6
5/8/00	<b>5.4</b>	6.52	4/2/01		7.4
5/9/00	7.4	<b>5.73</b>	4/9/01		7.5
5/22/00		7.59	4/16/01		7.4
5/25/00		7.59	4/23/01		7.3
5/30/00		7.7	4/30/01		7.0
6/6/00		7.43	5/7/01		7.0
6/12/00		8.2	5/14/01		6.9
6/19/00		7.65	5/21/01		6.9
6/26/00		6.82	5/29/01		7.1
7/5/00		7.68	6/4/01		6.8
7/10/00		7.49	6/11/01		7.0
7/17/00		7.75	6/18/01		7.1
7/24/00		7.58	6/25/01		6.9
7/31/00		7.69	7/2/01		6.7
8/7/00	7.5	7.64	7/9/01		7.1
8/14/00		7.85	7/16/01		7.1
8/21/00		7.62	7/23/01		7.1
8/28/00		7.71	7/30/01		6.6
9/06/00		7.92	8/6/01	6.8	7.5
9/11/00		7.8	8/13/01		8.0
9/18/00		7.68	8/20/01		6.8
9/25/00		7.76	8/27/01		6.8
10/2/00	6.8	7.74	9/4/01		7.3
10/9/00		7.6	9/10/01		6.7
10/16/00		7.74	9/17/01		6.6
10/23/00		7.54	9/24/01		7.2
10/30/00		7.62	10/1/01		7.1
11/6/00	6.6	7.56	10/8/01		7.1
11/13/00		7.2	10/15/01		7.0
11/20/00		7.42	10/22/01		6.8
11/27/00		7.2	10/29/01		7.5
12/4/00		7.4	11/5/01		6.9
12/11/00		7.56	11/12/01		7.1
12/18/00		7.26	11/19/01		6.9
12/26/00		7.45	11/26/01		7.3
1/2/01		7.33	12/3/01		7.2
1/8/01		7.42	12/10/01		7.4
1/15/01		7.32	1/2/02		6.8
1/22/01		7.24	2/4/02		7.8
1/29/01		7.27	3/4/02		8.1
2/5/01	6.5	7.8	4/1/02		7.3
2/12/01		7.6	5/6/02		7.1
2/19/01		7.6	6/3/02		<b>6.1</b>
2/26/01		7.5	7/08/02		6.8
Criteria Exceedences are in <b>BOLD</b>					

### **Kinnikinic Creek**

The low elevation BURP site on Kinnikinic Creek produced the only low MBI score (Table 12). The lower segment of Kinnikinic Creek below Sawmill Creek was 303(d) listed presumably as a result of impacts from the Clayton Silver Mine site. Further analysis of macroinvertebrate data (Clark, 2000) suggested that the lower site is impacted by fine sediment, but not temperature (see Appendix F). Fish surveyed by DEQ in 1998 below Broken Ridge Creek produced 15 cutthroat trout (multiple size classes). At the lowest site near Clayton six cutthroat trout (multiple size classes) were surveyed in 1998. The lower BURP site is located below the hydroelectric diversion. It is likely that impacts from flow alteration have had a greater effect on beneficial use support than any other perturbation to Kinnikinic Creek.

Prior to remediation the hydroelectric diversion fed water into a pipe that parallels the creek channel to the turbine site just above the confluence with the Salmon River. This diversion often dewatered the creek from the diversion to the return flow near Clayton. Beneficial Use Reconnaissance Project field notes indicate that there were “large deposits of sand + mine tailings all throughout the BURP sample reach.” The field notes go on to say that “There are many old mine timbers, pieces of old barrels, 5 gallon metal cans, and rags. There are also old coil springs and other assorted debris.”

As a result of full implementation of a Removal Action that was completed by the EPA and the US Coast Guard in October 2001 Kinnikinic Creek was isolated from contact with the tailings pile. The tailings pile was capped and stabilized to eliminate fugitive dust and migration of tailings into the creek from stream bank cutting and erosion (See Summary of Pollution Control Efforts).

The stream was constrained between the roadbed and bedrock below the Clayton Silver Mine, for most of its approximately 1 mile run, to the Salmon River. Remediation activities included rebuilding the stream channel to provide a wider flood plane than before. The roadbed is constructed of rock riprap adjacent to the stream, and is not a source of sediment. Full Implementation of the corrective Removal Action has eliminated the source of sediment to Kinnikinic Creek, reduced zinc loading to below water quality criteria and increased flow to move sediment out of the creek. No further implementation action should be required to reduce sediment and zinc loading to Kinnikinic Creek. It is expected that sediment will be transported out of the system and will not pose a threat to receiving waters.

Metals sampling was conducted by DEQ during base flow prior to completion of the remediation action. Dissolved zinc and cadmium levels were elevated above background levels but were below EPA Goldbook criteria at 100 ppm CaCo<sub>3</sub> hardness. All previous metals sampling data collected and reported by EPA, BLM and DEQ assumed 100 ppm CaCo<sub>3</sub> hardness. Hardness sampling conducted by BLM shows that hardness below the mine site in September 2000 was 297 mg/l CaCO<sub>3</sub> and 97 mg/l CaCO<sub>3</sub> at the mouth of Kinnikinic Creek. Sampling conducted by DEQ in September 2002 showed hardness at 104 mg/l CaCO<sub>3</sub> at the mouth.

**Table 14. Kinnikinic Creek Metals Assessment, 1999**

<b>Location</b>	<b>Date/Time Sampled</b>	<b>Cadmium (ug/l)*</b>	<b>Lead (ug/l)*</b>	<b>Zinc (ug/l)*</b>
<b>Upgradient (Mine)</b>	04/07/99 @ 11:47 A	<1	<5	<5
<b>Downgradient (Tailings)</b>	04/07/99 @ 11:57 A	<1	<5	225
<b>Mouth of Kinnikinic</b>	04/07/99 @ 12:10 P	<1	<5	34
<b>Upgradient (Mine)</b>	04/11/02 @ 2:04 P	<1	<5	<2
<b>Downgradient (Tailings)</b>	04/11/02 @ 3:21 P	<1	<5	34
<b>Mouth of Kinnikinic</b>	04/11/02 @ 3:27 P	<1	<5	62

\*EPA Gold Book Standards (ug/l) for 100 ppm CaCo3 eq hardness

	<b>Acute</b>	<b>Chronic</b>
<b>Cadmium:</b>	3.9	1.1
<b>Lead:</b>	82	3.2
<b>Zinc:</b>	117	106

A streambank erosion inventory was conducted in May 2002 above and below the Clayton Silver Mine and showed streambanks to be 81% stable below the Clayton Silver Mine with only slight streambank erosion. The upper reach was estimated to produce 18 tons per mile per year, while the lower reach estimate was for 12 tons per mile per year.

The hydroelectric diversion was likely having a significant impact on the aquatic life forms in Kinnikinic Creek prior to remediation. The affect was the combination of dewatering and the resulting elevated concentration of zinc at lower flows along the tailings. In April, 2002, three samples were collected along Kinnikinic Creek to evaluate the effect of the remediation project during base flow conditions, when metals loading would be expected to be highest. Samples were collected synoptically starting at a background site above the mine/mill and working to the mouth. All samples were filtered through a .45 micron filter and acidified with nitric acid and chilled to 4° C. Samples were sent to the Idaho State Laboratory for analysis. Results indicate that dissolved arsenic, cadmium, lead, and silver were below the detection limit of 5,1,5,5, and 1 ppb respectively for all sample sites. Dissolved zinc values ranged from <2ppb for the up gradient (background sample) to 34 ppb below the mine/mill site to 62 ppb at the mouth of Kinnikinic Creek. These values are still well below the aquatic life chronic criteria of 106 ppb (assuming hardness of 100 ppm CaCo3). It appears that some of the past zinc and cadmium concentrations have been reduced to levels below water quality criteria. As flow conditions change so may metal concentrations, though it is likely that at higher flows metals concentrations will be less. It does not appear that a TMDL for metals or sediment loading is not necessary for Kinnikinic Creek at this time. Elimination of unnatural flow alteration, eliminating sediment and metals loading from tailings piles, and maintaining current streambank stability conditions will likely improve conditions in the lower portion of Kinnikinic Creek to fully support beneficial uses.

**Table 15. Kinnikinic Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Above Cabin Creek (2310m)	Full Support (CWB,SS)	4.86	94	2.5	1996
Below Broken Ridge Creek (2206m)	Full Support (CWB,SS)	4.59	94	6.1	1996
Above Clayton near mouth (1706m)	Not Fully Supporting (CWB)	2.52	61	5.2	1996

Metals sampling will continue as part of the Removal Action, and DEQ will continue to sample metals concentrations to evaluate the loading response to remediation as well.

The USEPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance Memorandum (EPA 2001) describes the requirements for states reporting to EPA the water quality standard attainment status of Assessment Units of water bodies. Each Assessment Unit should be placed in only one of five unique assessment categories. Monitoring required to validate water quality management strategies for assessment units is conducted at appropriate intervals for each category. The categories are: 1) Attaining the water quality standard and no [beneficial] use is threatened; 2) Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. 3) Insufficient or no data and information to determine if any designated use is attained. 4) Impaired or threatened for one or more designated uses but does not require the development of a TMDL [because]: a) TMDL has been Completed or b) Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. 5) [beneficial] uses are limited and a TMDL is Required. The listed reach of Kinnikinic Creek falls under category 4.b of this guidance. Implementation of Best Management Practices are complete, and as riparian vegetation along the project reach mature and this reach is exposed to natural flow conditions water quality will continue to improve. Additionally, the impact of increased flow will improve habitat, macroinvertebrate and fisheries conditions.

### **Lost Creek**

Lost Creek is a small stream, possibly intermittent at times, near the headwaters of the Salmon River. The stream was sampled once near its mouth below a road bridge, which may not be representative of the condition of the entire stream (Table 12). Further analysis of macroinvertebrates (Clark, 2000) suggested that fine sediment (not temperature) may have impacted the aquatic community (see Appendix F), however, low flow (0.6 cfs) at the time of sampling may have also contributed to the low MBI score. DEQ conducted flow measurements during June of 2000 and June 2001, when other area streams were experiencing peak runoff. The flow measurement conducted above the Salmon Valley Road crossing of Lost Creek showed that the flow was less than 1 cfs (0.06cfs and 0.12 cfs) respectively. It is currently DEQ policy to not develop TMDLs for

streams with average flow less than 1 cfs for sediment or temperature. There is no indication of flow alteration above the sampling point, and the source of flow from Lost Creek has been determined to be a spring not far above the road crossing. The combination of low gradient and low flow reduce the potential for transporting sediment and the result would be accumulation of sediment. Lost Creek infiltrates long before connecting with the Salmon River, approximately 500 m below the road crossing. No TMDL for sediment or temperature will be prepared for Lost Creek.

**Table 16. Lost Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Valley Road (2115m)	Not Fully Supporting (CWB)	1.22	81	0.6	1996

### **Salmon River**

The BURP process for wadable streams applied to the headwaters area of the Salmon River produced two good scoring sites and two low scoring sites (Table 13). The two sites from 1998 have not been assessed yet. Sites sampled on the Salmon River suggest that different channel types may produce different MBI scores. Both C-type channels produced low scores where as other channel types (A, G) produced good scores. The 1993 and 1994 snorkeling data revealed young-of-year and yearling chinook, abundant steelhead, mountain whitefish, and cutthroat trout. In 1998, DEQ collected 17 brook trout (multiple size classes) and 18 sculpin from the lower (2304m) headwater site. The highest headwaters site (2383m) produced 10 cutthroat trout (multiple size classes) and two brook trout. This headwater area was deemed to fully support its uses and was not 303d listed in 1998. Two other sections of the Salmon River from Hell Roaring Creek downstream to the East Fork Salmon River were retained on the 1998 303d list from EPA's 1994 listing because of a lack of information at that time.

Recently, the Large River BURP process has sampled three sites on the Salmon River in the vicinity of this subbasin. The Salmon River at the Yankee Fork near Clayton and the Salmon River at the Pahsimeroi River near Challis produced some of the highest Fish River IBI (Index of Biotic Integrity) scores (95 and 93, respectively), and are considered of reference quality for large rivers (Christopher Mebane, personal communication). The Salmon River at Obsidian produced a slightly lower IBI of 87, though still considered a number that indicates full support of fisheries values. The Salmon River sites consistently had the highest number of cold water indicator species (5-6), high numbers of sculpin age classes (4-5), high sculpin percentages (28-54), highest percentage of cold water indicators (77-100), and high numbers of salmonid age classes (2-4).

Sediment monitoring completed by Environmental Science and Research Foundation at two sites on the Upper Salmon River show elevated depth fine sediment on the §303(d) listed reach below the confluence of Hell Roaring Creek and below the confluence of

Redfish Lake Creek. The percentage of depth fines less than 6.35 mm was recorded as 42% and 51% at the upper and lower sites respectively.

The primary overall source of fine sediment is considered to be stream bank erosion associated with winter ice damming and natural stream channel migration across the low gradient reach that extends across Decker Flat, from the confluence of Alturus Lake Creek downstream to the confluence of Williams Creek. Site specific activities just above depth fine and stream bank erosion inventory sites include activities associated with recreation and Streambank erosion inventories show that streambank erosion is slight over two reaches and moderate over one reach. Historic Land management along these reaches has been predominantly livestock grazing, however, improved land management techniques including riparian fencing and managed grazing prior to the listing of this reach has eliminated or greatly reduced the impacts to stream banks from grazing.

The Salmon River makes its transition to a medium sized river over this reach and the associated changes in channel characteristics affiliated with the observed gradient would include increased width to depth and increased deposition.

Additional fish sampling data collected by DEQ shows high index scores. Data was collected as part of the Large River BURP process. The §303(d) listed reaches of the Salmon River below Hell Roaring Creek (to Redfish Lake Creek), and from Redfish Lake Creek to the East Fork Salmon River are considered to be in Full Support of Aquatic Life Beneficial Uses. The Upper Salmon River does not require having a TMDL developed for sediment or temperature at this time because it is in full support of its beneficial uses.

**Table 17. Salmon River BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Headwaters above Frenchman Creek (2304m)	Full Support (CWB,SS)	5.02	111	17.1	1995
Between Alturas Lake Creek and Hwy 93 (2081m)	Full Support (CWB,SS)	3.13	69	125.1	1995
Highest headwaters site (2383m)	<i>NA</i>	5.29	<i>NA</i>	17.9	1998
Headwaters above Frenchman Creek (2313m)	<i>NA</i>	2.48	<i>NA</i>	32.6	1998

### **Squaw Creek**

Squaw Creek was originally determined to be in full support of its existing beneficial uses and was not put on the 1998 303d list (Table 16). Subsequently, EPA indicated that

Squaw Creek should be added to the 1998 303d list because of concerns with water temperature. EPA references DEQ's BURP data as the source of temperature data for Squaw Creek. DEQ BURP field crews routinely collect an instantaneous measurement of water temperature while performing other sampling. These measures may occur at anytime during the day depending on when the crew is at the site. The instantaneous measurements taken at the four BURP sites vary from 12°C to 18°C. The temperatures collected in BURP surveys do not indicate exceedance of state cold water aquatic life or bull trout temperature criteria.

Continuously recorded thermographs were reviewed (1999 data) for lower Squaw Creek (BLM, 1999b). These data show daily averages in addition to daily maximums and 7-day average maximums. No stream sampled exceeded a daily average water temperature of 19°C in 1999. In fact, most streams had daily averages from 12° to 14°C through the summer months (July and August), dropping below a daily average of 12°C by August 30, 1999. The daily average water temperature for Squaw Creek varied from 10° to 13.5°C during July and August. In September, the daily average for Squaw Creek drops to 8° to 10°C. The 7-day average maximum water temperature for Squaw Creek varies from 15.5° to 18°C during July and August, drops to about 13.5°C around the 1<sup>st</sup> of September, and then drops below 10°C before September 25, 1999.

Squaw Creek was monitored by USDA FS for temperature in two places (upper and middle), as well as in five of its tributaries (precise locations were not provided by the Forest Service) (Table 20). Upper and middle Squaw Creek reached peak maximum water temperatures of 16.8° and 17.5°C, respectively. The highest 7-day average maximum water temperatures were 15° and 16.1°C for upper and middle Squaw Creek. In middle Squaw Creek, the 7-day average maximum fell below 13°C after August 31, 1999 and below 12°C by September 21, 1999. Upper Squaw Creek fell below 12°C 7-day average maximum after August 31, 1999. Water temperatures for the five tributaries of Squaw Creek are listed in Table 20 (and Appendix D). Data for Squaw Creek are very consistent with BLM data for lower Squaw Creek discussed previously. These streams appear to meet cold water biota temperature criteria throughout the summer of 1999 and met state salmonid spawning criteria by September 1, 1999 (currently 13° C as a daily maximum and 9° C as a daily average). Because daily averages were not calculated, it is unknown if these streams met the state's bull trout temperature criterion of 12°C (the criteria at the time of compilations) daily average on Forest Service land. Current state temperature criteria for bull trout rearing is 13°C Maximum Weekly Mean Temperature during June, July and August, and 9°C Maximum Daily Mean Temperature during September and October.

Temperature data collected by USDA FS and BLM and shown in Table 20 and Appendix D do not indicate exceedance of cold water aquatic life criteria. The data provided is not adequate to determine if there is exceedance of the state water quality criteria for bull trout because the data shows only the 7-day average of daily maximum temperatures and daily maximum temperature. Raw data was not provided for evaluation. State criteria are based on weekly and daily mean temperatures. Bull trout are not known to historically spawn or rear near the lower reaches of Squaw Creek.

A juvenile steelhead acclimation pond has been constructed approximately one mile upstream of the mouth. The acclimation pond was a cooperative project between IDFG, BLM and Thompson Creek Mine. Water to the pond is provided from Squaw Creek and effluent from the pond is returned to the Creek. Since construction of the pond in 1999 there has not been any indication of thermal stress to the steelhead smolts or residualized smolts held after volitional release.

Macroinvertebrate data for these sites were further analyzed to determine if the aquatic community shows any signs of temperature impacts (Clark, 2000, see Appendix F). Clark (2000) indicated that there were no apparent impacts from temperature reflected in the macroinvertebrate data.

In upper Squaw Creek, 14 sculpin (multiple size classes), five rainbow trout (three size classes), and two cutthroat trout were collected by DEQ in 1998. Five rainbow (two year classes), one mountain whitefish, and eight sculpin were collected by IDFG in 1994. Below the Thompson Creek Mine, one rainbow/steelhead and 22 sculpin were collected in 1994 by IDFG. Mountain whitefish, sculpin, and multiple year classes of rainbow trout were collected in 1991 during mine studies.

There is some potential that the lower portion of Squaw Creek is influenced by geothermal activity based on discussions with local management agency personnel, though this has not been documented. Elevated stream temperature can result from the combined effect of flow alteration and geothermal inflow.

There is not adequate indication that a TMDL is warranted for the lower reach of Squaw Creek. Cold water aquatic life appears to be fully supported, and bull trout spawning and rearing do not occur on the lower mile of Squaw Creek. Due to the lack of definitive temperature data, and the fact that Squaw Creek was not originally listed as impaired on the 1998 §303(d) list a TMDL for temperature will not be prepared at this time. Monitoring for beneficial uses will continue and the potential for future TMDL development will be evaluated based on future monitoring results. Available data show full support of existing beneficial uses.

**Table 18. Squaw Creek BURP Assessment**

BURP Site Location	Assessment	MBI Score	Habitat Score	Flow (cfs)	Year
Below Martin Creek (1962m)	Full Support (CWB, SS)	4.76	78	15.2	1995
Below Cinnabar Creek (1865m)	Full Support* (CWB, SS)	3.35	85	2.7	1994
Below Boundary Creek (1804m)	Full Support (CWB, SS)	4.25	89	27.8	1995
Below Bruno Creek (1731m)	Full Support (CWB, SS)	4.54	82	4.0	1994

\*Needs verification status was upgraded to full support because of fish data.

## Abandoned Mines and Mill Sites and NPDES Discharges

Recently, DEQ surveyed a number of major abandoned mine and mill sites in the Upper Salmon subbasin. Table 15 lists those sites visited and any possible concerns noted. In most cases, elevated metals levels are based on a single grab sample of discharge or drainage water. These samples do not necessarily mean the receiving water will exceed water quality standards. More sampling is needed to ascertain any standards violations.

Van Gosen et al. (2000) sampled surface waters, stream sediments, soils, and waste rock materials for heavy metals at the abandoned Thompson Creek tungsten mine site near Basin Creek. Surface water samples were taken upstream from the mine site, downstream from the mine, and in a mine drainage pool coming from the adit.

**Table 19. Abandoned mine and mill sites visited by DEQ in 1998 (Modroo, 1999).**

Facility Name	Water Body	Comments
Hoodoo Mine/Mill	Slate Creek	No apparent water quality problems
Clayton Silver Mine/Mill	Kinnikinic Creek	Single sample in 1998 showed tailings high in As, Pb, Ag, Zn. 1994-1995 sampling showed high levels of dissolved Pb and Zn below tailings. Sb and Cd may also be of concern.
Silver King Mine/Mill	Beaver Creek	Arsenic has exceeded 50 ug/l in discharge water.
Valley Creek Mine/Mill	Valley Creek	No apparent problems
Livingston Mill	Big Boulder Creek Jim Creek	Possible increased levels of dissolved copper, cadmium, and zinc.

These samples were analyzed for dissolved and total metals at levels sufficient to detect below water quality standards values. None of these samples showed metals exceeding Idaho water quality standards except for zinc in the mine drainage pool. Zinc was reported as 190 ug/l in this pool, whereas the dissolved chronic criterion for zinc at the hardness reported for the pool (100 mg/l as  $\text{CaCO}_3$ ) is 104 ug/l. The pH in all three water samples (upstream = 5.5, downstream = 5.8, and adit pool = 5.7; Van Gosen et al., 2000) were below Idaho water quality standards of 6.5 to 9.0. Acid mine drainage may be a problem in this area.

Stream sediment samples taken upstream and downstream of the Thompson Creek tungsten mine (Van Gosen et al., 2000) site showed values for chromium, copper, lead, and zinc in excess of Idaho water quality standards. However, these two media may not be directly comparable, especially since water column values were not exceeding water quality standards.

There are potentially seven NPDES discharges associated with five facilities in the Upper Salmon subbasin (Table 16). All of these outfalls discharge to 1998 303(d) listed and

proposed streams or their tributaries. Jordan Creek is tributary to Yankee Fork, Buckskin and Pat Hughes Creeks are tributary to Thompson Creek, Bruno Creek is tributary to Squaw Creek, and Valley Creek is tributary to the Salmon River. It would be expected that each outfall would have specific monitoring requirements for their respective receiving streams. The Stanley Sewer Association has proposed to discontinue stream discharge and to route wastewater to Forest Service lagoons for eventual land application of treated effluent (Domingo, 2000). It was not determined if Epicenter Aquaculture has an active discharge or what is the receiving stream. Based on the address provided in EPA's online Permit Compliance System, Epicenter Aquaculture would likely discharge to Warm Springs Creek or the Salmon River near Challis.

**Table 20. NPDES Discharge Outfalls in the Upper Salmon Subbasin.**

Facility	Outfall Points
Epicenter Aquaculture #000009911198	Warm Springs Tilapia Facility – outfall unknown
Sawtooth Fish Hatchery #ID0000487660	Salmon River (outfall 001)
Hecla Mining Co. Grouse Creek Unit #IDD000643254	Jordan Creek (outfall 001)
Thompson Creek Mining Co. #IDD000756874	Buckskin Creek (outfall 001) Pat Hughes Creek (outfall 002) Bruno Creek (outfall 003)
Stanley Sewer Association #ID0000496349	Valley Creek (outfall 001) (proposed to be discontinued, Domingo, 2000)

## **Bureau of Land Management and Forest Service Assessments**

The Salmon-Challis National Forest has monitored substrate conditions on a number of streams in the subbasin through core sediment sampling (SCNF, 1999). These data are presented in Table 18. Although not 303(d) listed in the National Forest, Challis and Garden Creeks have a significant decreasing trend in core sampled sediment since 1995. Thompson Creek and the Yankee Fork are 303(d) listed for sediment within Forest boundaries. The one sampling site on Thompson Creek has shown a significant decreasing trend in core sampled sediment. It is unknown if the site sampled is above or within the listed segment. Two sites on the Yankee Fork show a significant increasing trend and two sites show a significant decreasing trend. A fifth site has remained relatively stable with regard to core sampled sediment trends. Most sites on 303d listed streams in 1999 are below a core sampled sediment mean value of 28 %. One site on the Yankee Fork (4A) has had values slightly in excess of 28% mean core sampled sediment. Other streams (not 303d listed) with high sediment values include Morgan Creek (3A), East Pass Creek (1A), Herd Creek, and Tenmile Creek. It is assumed that data in Table 18 are from spawning gravel locations in these streams. However, locations have not been verified.

The Challis Field Office of the Bureau of Land Management (BLM) collected streamflow and water quality data on selected streams in 1999 and 2000 (Appendix B). These data

show total dissolved solids (TDS in ppm), turbidity (NTU), and water temperature (°C) values for Kinnikinic Creek, Road Creek, Garden Creek, and Challis Creek among others.

**Table 21. Salmon-Challis National Forest Core Sampling Sediment Data (SCNF, 1999)**

Core Sampling Sediment Trends - 1995 to 1999 - Mean Percent (%) Fines					
Stream/Station	1995	1996	1997	1998	1999
Morgan Cr.1A	38.5	34.3	29.3	22.8	24.8*
Morgan Cr.2A	34.4	34.5	31.7	22.0	23.8*
Morgan Cr.3A	42.3	27.7	41.3	31.4	39.4
WFMorgan Cr.	36.2	33.0	23.4	11.4	25.6*
<b>Challis Cr.1A</b>	44.1	41.1	17.4	13.0	21.3*
<b>Challis Cr.2A</b>	-	-	29.2	-	22.0
<b>Garden Cr.1A</b>	22.4	-	19.0	12.3	18.0*
E. Pass Cr.1A	27.1	31.9	31.2	37.9	38.8#
Herd Cr.	30.1	31.0	32.5	28.4	30.7
WF Herd Cr.1A	20.4	27.2	27.2	27.2	25.2#
Squaw Cr.1A	25.9	24.2	27.4	23.5	30.5#
Trail Cr.1A	-	27.0	-	-	-
<b>Thompson Cr.1A</b>	25.1	20.2	25.4	16.5	-.*
<b>Yankee Fork 1A</b>	27.1	20.5	19.6	27.8	24.1
<b>Yankee Fork 2A</b>	15.6	29.5	14.9	22.6	27.5#
<b>Yankee Fork 3A</b>	13.2	29.1	5.3	14.7	24.2#
<b>Yankee Fork 4A</b>	40.6	36.1	27.4	25.2	32.7*
<b>Yankee Fork 5A</b>	31.5	29.7	23.6	21.0	15.7*
WF Yankee Fork	21.9	-	27.5	18.1	25.1
Jordan Cr.0A	26.2	32.1	18.4	13.9	15.3*
Jordan Cr.1A	17.6	-	-	-	-
Jordan Cr.2A	16.0	22.5	18.0	17.5	21.1#
Jordan Cr.3A	14.3	23.5	16.7	10.9	23.1#
Jordan Cr.4A	13.5	-	-	-	-
Fivemile Cr.1A	14.3	-	20.8	28.8	11.7
Tenmile Cr.1A	32.3	-	36.9	28.5	33.7
McKay Cr.1A	19.0	-	29.3	33.2	30.1#
Basin Cr.1A	33.3	28.5	22.3	13.5	32.4
Valley Cr.1A	41.1	-	-	-	-

\*Significant decrease over the five-year period (1995-1999).

#Significant increase over the five-year period (1995-1999).

Streams in **bold** are 303(d) listed for sediment.

The sampling site on Kinnikinic Creek is reported to be above the Clayton Silver Mine tailings. Kinnikinic Creek, measured on September 1, 1999, showed 50ppm TDS and a clear NTU at 9°C. The Road Creek sampling site produced a TDS of 160ppm and 6.55 NTU at 15°C on August 19, 1999. Garden Creek produced a TDS of 80ppm and 0.92

NTU at 6.5°C on October 13, 1999. Two sites on Challis Creek, one sampled on August 16, 1999 and the other on October 5, 1999, showed TDS values of 40ppm for both, 2.51 and 3.47 NTU at 17° and 10°C, respectively.

The Challis Field Office of BLM has recorded water temperatures in several streams throughout the subbasin using continuous recording HOBO-type thermographs (BLM, 1999b). Within the East Fork Salmon River drainage, Bear, Big Boulder, Big Lake, Herd, Horse Basin, Lake, Little Boulder, Mosquito, and Road Creeks have been measured every year since 1995 (Appendix C). Elsewhere in the subbasin, Bayhorse, Morgan, WF Morgan, Squaw, and Thompson Creek have been measured since 1995. Data reviewed for this assessment includes the highest recorded maximum temperature for all years and the highest recorded 7-day average maximum temperature for 1998 and 1999. Additionally, thermographs for the entire 1999 sampling season were reviewed. In 1996, two streams exceeded 22°C with the highest recorded maximum water temperature (BLM, 1999b). Lower Horse Basin Creek and Road Creek below Horse Basin Creek had maximum temperatures of 23.6°C and 22.9°C in 1996. These two streams did not achieve these high temperatures in any other year sampled. In 1998, Big Lake Creek and Morgan Creek exceeded 22°C (22.9° and 22.5°C, respectively) maximum water temperature. Squaw Creek is proposed for 303(d) listing by EPA for alleged temperature problems. These BLM data show maximum water temperatures for Squaw Creek ranging from 19.6° to 20.4°C (1997 and 1998, respectively).

Continuously recorded thermographs were reviewed (1999 data) for the above creeks (BLM, 1999b). These data show daily averages in addition to daily maximums and 7-day average maximums. No stream exceeded a daily average water temperature of 19°C in 1999. In fact, most streams had daily averages from 12° to 14°C through the summer months (July and August), dropping below a daily average of 12°C by August 30, 1999. The daily average water temperature for Squaw Creek varied from 10° to 13.5°C during July and August. In September, the daily average for Squaw Creek drops to 8° to 10°C. The 7-day average maximum water temperature for Squaw Creek varies from 15.5° to 18°C during July and August, drops to about 13.5°C around the 1<sup>st</sup> of September, and then drops below 10°C before September 25, 1999.

The Salmon-Challis National Forest also provided 1999 thermograph data for various streams in the Yankee Fork Ranger District (see Appendix D). Only daily maximums and 7-day average maximums are presented, daily averages were not calculated. Of the 22 creeks surveyed, two creeks exceeded the 22°C maximum cold water biota criterion (Appendix D). Lower Basin Creek had a peak maximum water temperature of 23.3°C and exceeded 22°C approximately 12 times from July 13 to August 31, 1999. Lower Knapp Creek had a peak maximum water temperature of 23.7°C and exceeded 22°C approximately six times from July 6 to August 1, 1999. No other creeks exceeded 22°C maximum water temperature. Squaw Creek was monitored for temperature in two places (upper and middle), as well as in five of its tributaries. Upper and middle Squaw Creek reached peak maximum water temperatures of 16.8° and 17.5°C, respectively. The highest 7-day average maximum water temperatures were 15° and 16.1°C for upper and middle Squaw Creek. In middle Squaw Creek, the 7-day average maximum fell below

13°C after August 31, 1999 and below 12°C by September 21, 1999. Upper Squaw Creek fell below 12°C 7-day average maximum after August 31, 1999. Water temperatures for the five tributaries of Squaw Creek are listed in Table 20 (and Appendix D). Data for Squaw Creek are very consistent with BLM data for lower Squaw Creek discussed previously. These streams appear to meet cold water biota temperature criteria throughout the summer of 1999 and meet salmonid spawning criteria by September 1, 1999. Because daily averages were not calculated, it is unknown if these streams meet the state's bull trout temperature criterion of 12°C (at the time of compilations) daily average on Forest Service land. This daily average was exceeded slightly (to 13.5°C) on BLM land during July and August.

**Table 22. Maximum Water Temperatures Within the Squaw Creek Drainage.**

Water Body	Highest Maximum (°C)	Highest 7-day Average Maximum (°C)
Aspen Creek	14.9	10.5
Cash Creek	17.9	16.9
Cinnabar Creek	13.4	8.3
Martin Creek	17.5	15.3
Trealor Creek	14	13
Upper Squaw Creek	16.8	15
Middle Squaw Creek	17.5	16.1

### USGS Station Data

The US Geologic Service (USGS) has maintained water monitoring stations periodically throughout the subbasin. These data are in Appendix E. Suspended sediment was monitored at several locations on the Salmon River from 1971 to 1973. The Salmon River below Yankee Fork (Station # 13296500) had suspended sediment concentrations that varied from 1 mg/l to 41 mg/l. Only two of ten samples were greater than 30 mg/l (32 mg/l and 41 mg/l). At the Salmon River above the East Fork Salmon River (Station # 13297380) suspended sediment concentrations were from 2 mg/l to 109 mg/l. Again only two of nine samples were greater than 30 mg/l (49mg/l and 109 mg/l). In the Salmon River near Challis suspended sediment was between 2 mg/l and 172 mg/l. Three of ten samples were greater than 30 mg/l (56, 130, and 172 mg/l). Of all USGS sample sites reporting suspended sediment 30 mg/l or greater 20 out of 26 events occurred during the last two weeks of June, the period of peak runoff from snowmelt in most years. This is also a time when severe thunderstorms take place in the subbasin.

Maximum and minimum water temperatures were also monitored by USGS in the Salmon River above Redfish Lake Creek from 1978 to 1984 (Appendix E). Water temperatures never exceeded 20°C during those years, although it was not uncommon for water temperatures to be that high in July and August. In September maximum water temperatures in the Salmon River were occasionally as high as 16-17°C, especially during the first week of September. In most years, September water temperatures were frequently below a maximum of 13°C, and in October water temperatures exceeded 13°C only once during the monitoring period.

## **Environmental Science & Research Foundation Assessment**

The Environmental Science & Research Foundation during the summer of 2000 sampled sediment and assessed stream erosion and road erosion at several sites on Warm Spring Creek, Challis Creek, Garden Creek, Road Creek, Slate Creek, and the upper Salmon River above Stanley (Blew, 2000). Warm Spring Creek was the only stream in this group to also receive nutrients and bacteria sampling. The one time sampling event on June 8, 2000 at two locations produced slightly elevated (above the EPA Goldbook (1986) recommendation of 50 ug/l) total phosphorus concentrations. One site, approximately 1 mile below the hatchery was 60 ug/l. The other site several miles below had 20 ug/l total phosphorus. Both samples taken from Warm Springs Creek water were from agricultural ditches. Fecal coliform bacteria samples were high at both sites on the same day (1300 and 2420 cfu/100ml). *E. coli* samples were above standards at only one site (1046 cfu/100ml) and below standards at the other site (45 cfu/100ml). Caution should be used in interpreting bacteria and nutrient results, as a single sample is insufficient to determine the nature and extent of any problems.

McNeil core sediment sampling took place at two sites on Challis Creek and two sites on Garden Creek, one above the Forest boundary and one below for each stream (Blew, 2000). Percent depth fines for the upper sites were 41% for Challis Creek and 38% for Garden Creek. Lower sites recorded 44% and 35% depth fines for Challis Creek and Garden Creek, respectively. Other streams receiving sediment sampling were one site on Road Creek (47% depth fines), one site on Slate Creek (30% depth fines) and two sites on upper Salmon River (42% and 51%). Most of these samples suggest an excess of fine sediment in these streams.

Blew (2000) also assessed stream erosion rates and road erosion at several locations along Challis Creek, Garden Creek, Road Creek, and Slate Creek. Stream erosion rates were also assessed at three reaches along the upper Salmon River. Challis Creek had one slight eroding reach, three moderately eroding reaches and one severely eroding reach. Garden Creek had one moderately eroding reach and one severe. Road Creek had three slightly erosion reaches and one moderately eroding reach. Slate Creek had one moderately eroding reach recorded. The Salmon River had two slightly eroding reaches and one moderate. Lateral recession rates and erosion rates were listed for all these locations in Blew (2000), however, measurement units were not included.

### **Assessment Data Gaps**

Most listed streams lack sufficient data to perform TMDLs. Challis Creek, Garden Creek, and Warm Spring Creek are all listed for sediment and nutrients, however, these data are very limited for the listed portions of these streams (Table 19). Challis and Garden Creeks have limited sediment data above and below the Forest Service boundary. The lower portions of these streams, as well as most of Warm Spring Creek are on private ground for which there is little data. Road Creek was assessed using the R1/R4 stream procedure for aquatic habitat conditions. BLM indicated that instream fines were

above standards (probably Pacfish/Infish) and above natural conditions database (BLM, 1999a).

Thompson Creek, the Yankee Fork, and the Salmon River have some limited sediment data, core samples for all three and suspended sediment for the latter. However, it is unlikely that these data sufficiently characterize the stream to determine a TMDL, with the possible exception of the Yankee Fork, which has core samples from a number of sites.

Metals data exists for Thompson Creek however additional follow-up metals data are needed for Kinnikinic Creek to better characterize the effects of remediation activities and any additional leaching from tailings after remediation activities were completed in 2001.

**Table 23. Data gaps for 303(d) listed water bodies.**

1998 303(d) Listed Waters	Listed Pollutant	Data Gaps
Challis Creek	Sediment Nutrients	no nutrient data one sediment sample below FS boundary
Garden Creek	Sediment Nutrients	no nutrient data one sediment sample below FS boundary
Warm Spring Creek	Sediment Nutrients	two nutrient samples no sediment data
Road Creek	Unknown (sediment?)	BLM has aquatic habitat data based on R1/R4 procedures. One depth fine sample.
Kinnikinic Creek	Unknown (sediment, metals?)	Need follow-up monitoring of post remediation sediment and metals.
Thompson Creek	Sediment Metals	Some sediment data available Metals data from NPDES and USGS
Yankee Fork	Sediment Habitat alteration	Some sediment data available
Lost Creek	Unknown	No data
Salmon River	Sediment Temperature	Limited suspended sediment and Temperature data available. Two depth fine samples.

## **Pollutant Source Inventory**

Pollution sources for the 303(d) listed segments of Challis Creek appear to be related to mass wasting, streambank erosion and road erosion. Further down stream, below Mill Creek flow alteration and streambank erosion are important. Pollution on Garden Creek, and Warm Spring Creek are agriculture-related activities on private ground with flow

alteration the significant primary perturbation. Sediment sources associated with Road Creek are likely agricultural activities on private ground on the lower reach, cattle grazing and associated riparian impacts, and road erosion. Flow alteration on the lower reach of Road Creek is the significant primary perturbation.

Pollution sources for the 303(d) listed portion of Thompson Creek appear to be the sources of the iron hydroxide deposits around the Scheelite Jim mill. Likewise, pollution sources for sediment and possibly metals in the listed portion of Kinnikinic Creek appear to have been associated with the Clayton Silver Mine and tailings piles along the creek. Sediment sources in the Yankee Fork are likely associated with the dredge mining operation and possible other mining activities in the vicinity.

Sediment sources for the Salmon River are bank erosion and inputs from tributary contributions.

### **Pollutant Source Data Gaps**

No information is available on pollutant sources in Lost Creek, in the Upper Stanley Basin, however, it appears that natural low flow limits beneficial use support here.

### **Summary of Pollution Control Efforts**

The Upper Salmon Basin Watershed Project (USBWP) (formerly known as the Idaho Model Watershed Project), was initiated in 1992 with funding from the Bonneville Power Administration. The USBWP has been working on various projects in the Lemhi River, Pahsimeroi River, and East Fork Salmon River, and the mainstem Salmon River to restore and maintain aquatic habitats for resident and anadromous fish (Seaberg, et al., 1997). The Project works with agencies and landowners on a cost share basis to accomplish goals. Work includes fencing riparian areas, restoring and protecting streambank stability, diversion structure screening and consolidations, and many other activities. For example, the Project participated with the Hannah Slough Project on the Salmon River near Challis involving riparian management and bank stabilization.

#### **East Fork Salmon River**

Additional projects include three miles of riparian corridor in Herd Creek, stabilizing 10,000 feet of streambank in Herd Creek, improving irrigation diversions in the East Fork drainage, and the East Fork Ten-Mile Project which involved a combination of bank barbs and fencing to improve habitat conditions. The Project has been investigating expansion of their activities into other parts of the Upper Salmon subbasin including participation with the Yankee Fork restoration and diversion consolidations in Valley Creek.

#### **Road Creek**

The Road Creek watershed is primarily impacted by grazing activities. Three riparian exclosures have been built by the BLM (Kate Forster, personal communication) on Road Creek and its tributaries to exclude livestock from riparian areas. One large exclosure

was built on Horse Basin Creek from the confluence with Corral Basin Creek to Road Creek. More than a mile of riparian habitat is protected with this enclosure. The other two enclosures, each about two acres in size, are located near Cow Camp (10N, 20E, sec. 35) and Boulevard Springs (9N, 20E, sec. 34).

### **Warm Spring Creek**

Private lands surround the majority of Warm Spring Creek proper. There are only a few areas where public lands are adjacent to the creek. One such area near McGown Creek has a grazing enclosure on BLM land to protect the riparian area (Kate Forster, personal communication).

### **Kinnikinic Creek**

Work was completed in October 2001 to reduce erosion from the tailings piles of the Clayton Silver Mine into Kinnikinic Creek. The tailings pile was reshaped and capped, the road was moved away from the creek to create a wider stream corridor, and tailings adjacent to the stream were ripraped to reduce erosion. A new flood plane was constructed for Kinnikinic adjacent to the tailings. Riparian rehabilitation is planned for 2002 and 2003 adjacent to the channel reconstruction. Dewatering of the stream channel has ended with elimination of the hydroelectric pipeline diversion at the Clayton Silver Mine.

The following is a scope of work for reducing erosion from the Clayton Silver Mine tailings piles into Kinnickinick Creek provided by Greg Weigel, EPA Region 10, Idaho Office:

**CLAYTON SILVER MINE  
REMOVAL ACTION  
SCOPE-OF-WORK**

**OBJECTIVES**

This scope-of-work (SOW) specifies required actions to fully implement a Removal Action (RA) at Clayton Silver Mine (CSM). This SOW is specific to a RA to isolate Kinnickinick Creek from contact with the tailings pile and reduce the potential for mass failure and erosion of the tailings, and continued release of tailings pile fines to the surrounding environment via wind and hydraulic erosion. There may be additional hazards to human health and the environment caused by other aspects of CSM, but they are not addressed herein. The specific goals of this SOW are:

- 1) Evaluate and, if necessary, mitigate the potential for slope failure of the tailings pile.
- 2) Isolate Kinnickinick Creek from contact with the toe of the tailings pile to prevent continued migration of tailings to the creek via streambank cutting and erosion of the tailings pile.
- 3) Stabilize the tailings pile from continued wind and hydraulic erosion using a cover of vegetation or other native material.

**ALTERNATIVES ASSESSMENT**

The following technologies have been identified as being potentially feasible. The initial assessment report shall include these as a minimum:

- \$ stream relocation away from toe of tailings;
- \$ modification of tailings slope;
- \$ armoring at toe of tailings;
- \$ engineered cover system using vegetation and/or native materials, and/or;
- \$ diverting run-on and run-off.

The following data gaps are known to exist and shall, at a minimum, be addressed in the initial assessment report:

- \$ chemical and physical properties of native and tailings pile soils, and;
- \$ detailed topographic mapping.

**Thompson Creek**

In 1996, barbs and streambank revetment structures were constructed to reduce sediment impacts from eroding banks (see Appendix H). In 1997, eight more barbs were constructed and riparian plantings occurred in an effort to further reduce the sediment impacts to aquatic habitat.

Livestock management plans to provide for better riparian condition and bank stability were improved in 1997 as well (Appendix H).

Restoration work at the Scheelite Jim mill site began in 1992 with the creation of a wetland to trap heavy metals and ARD from the site to improve water quality. Subsequent improvements to the wetland project have been ongoing (Appendix H).

### **Yankee Fork**

In 1996 and 1997, phases one and two of Preacher's Cove reclamation project were implemented to remove hazardous materials and stabilize mill site to protect aquatic resources (Appendix H). The lower Jordan Creek wetlands and stream channel restoration was conducted by Hecla Mining from 1997 to 1999.

There are ongoing projects to reclaim dredge piles and to restore stream and active floodplain geomorphology as well as create off-channel fisheries habitat (Appendix H).

### **Other Projects**

Problems in upper Alturas Lake Creek, where the creek has abandoned its channel to flow down a road, are planning to be addressed through restoration activities (Nourse, 2000). The creek will be rerouted back to its original channel and transportation systems will be corrected and rearranged to prevent further degradation of the resource. Implementation is slated for late fall 2000.

The Busterback Ranch irrigation project in the early 1990s was designed to reduce Salmon River diversions in the Alturas Lake Creek area by converting from overland flow irrigation to ground water-based sprinkler irrigation.

See Appendix H for list of other projects on non-303d listed streams within the subbasin.

## **SUMMARY**

### **Challis Creek, Forest boundary to mouth; sediment, nutrients, flow alteration**

The land surrounding Challis Creek below the Forest boundary is primary privately owned and is in agricultural/grazing use. The stream is apparently often dewatered in these lower reaches for irrigation use. No data are available on nutrient conditions in this lower section of the creek. One sediment sample suggests high depth fines. The impacted area includes a portion of National Forest land immediately upstream of the Forest boundary. Forest Service data suggests that sediment amounts, once high in Challis Creek, are improving. During fieldwork conducted by DEQ no evidence of nuisance levels of aquatic plants or algae growth were observed to indicate that a nutrient TMDL is warranted. A sediment TMDL is developed in this document to assist ongoing and planned restoration work to reduce sediment inputs and improve anadromous and resident fisheries.

### **Garden Creek, Forest boundary to mouth; sediment, nutrients**

Like Challis Creek, Garden Creek below the Forest boundary is surrounded by private agricultural/grazing ground. The creek is also used as the municipal water supply for the City of Challis during periods of high flow in the spring. Dewatering of the stream channel is the most pervasive perturbation to aquatic beneficial uses. Monitoring and observations suggest that the only impacted portions of the creek are within the lower

private land reaches particularly within the City of Challis. No nutrient data are available for this portion of the creek. One sediment sample suggests high depth fines. Garden Creek will be listed for flow and habitat alteration only from the upstream City limit to its confluence with Hannah Slough. Above the city boundary Garden Creek fully supports beneficial aquatic life uses. No sediment TMDL will be prepared for Garden Creek.

#### **Warm Spring Creek, headwaters to sink; sediment, nutrients**

Warm Spring Creek, by virtue of its diversion from its natural stream channel into a constructed channel that conveys water from a hatchery to a hydroelectric plant over the course of its flow, and its lack of connectivity to other surface waters, does not warrant a TMDL. The temperature regime of Warm Spring Creek is naturally elevated beyond state water quality criteria for cold water and altering the temperature regime is not possible or advisable. The diversion ditch that carries Warm Spring Creek's entire flow is stable and non-erosible. However, no sediment data are available for the ditch and one time nutrient sampling is inconclusive. Nuisance levels of aquatic plants or algae have not been observed in the diversion ditch. Warm Spring Creek is geothermally influenced and at most could be considered artificial warm water/neotropical fish habitat.

#### **Road Creek, headwaters to mouth; unknown**

Road Creek has had a number of impacts over the years because it is a drainage that is almost entirely used for grazing. Improvements in grazing management have been made and response is noted in the fishery. Multiple year classes of cutthroat and rainbow trout are found in Road Creek. Road Creek is a spring creek system that is not exposed to high magnitude hydrologic peak flow during snowmelt. Spring creeks typically exhibit higher percentages of fine sediment. The lower reaches are also dewatered and used for private land irrigation. A road parallels the creek for most of its length and is often in the limited floodplain. Macroinvertebrate analyses indicate that the stream may be impacted by fine sediment, however the greater impact to the lower sample site is dewatering of the stream channel. Sediment core sample data suggests that fine sediments are elevated in this stream, however, fisheries data suggest that Road Creek is in full support of beneficial uses above the dewatered reach of the stream. Spring source creeks often show elevated fine sediment due to limitations in sediment transport capability related to low peak flows. Problem areas are restricted to lower reaches that are dewatered and headwater reaches that are ephemeral. Temperature does not appear to be a problem. Road Creek will be listed for flow alteration only from the lower BLM boundary, approximately 1 mile above its confluence with the East Fork Salmon River to its confluence.

#### **Thompson Creek, Scheelite Jim Mill to mouth; sediment, metals**

Thompson Creek below the Scheelite Jim mill site has probably been affected by historic iron oxide (FeOx) and manganese oxide (MnOx) deposits that have previously armored the substrate and turned the sediments to a yellow color from the mill site to the confluence with the Salmon River. This appears to be the only historically impacted area on this stream. There has been significant reclamation work associated with this mill site, since 1992, prior to its §303(d) listing, and significant improvements in fisheries and macroinvertebrates have accrued to restore full support to the listed reach (IDEQ 1999a, Marvin Granroth, USDA FS, personal communication). No mining related problems

were discovered in other portions of Thompson Creek. A TMDL is not warranted for any pollutants in Thompson Creek. Thompson Creek will be listed into category 4b of the EPA 2002 Integrated Water Quality Monitoring and Assessment Report Guidance. The stream's beneficial use support has been threatened, but does not require the development of a TMDL because other pollution control management practices are reasonably expected to result in the attainment of state water quality standards in the near future.

**Yankee Fork, 4<sup>th</sup> of July Creek to mouth; sediment, habitat alteration**

The Yankee Fork from Fourth of July Creek to mouth has had habitat severely altered by dredge mining. Forest Service core sediment data show that one monitoring site has elevated average depth fine sediment, though monitoring during several monitoring years have been below target levels. Habitat restoration has been a priority for the ShoBan Tribes and state and federal agencies and has attracted the attention of the Idaho Model Watershed Project. Many improvements have been implemented with others planned. The Yankee Fork of the Salmon River is in full support of beneficial uses and will not have a TMDL developed for sediment or metals.

**Kinnikinic Creek, Sawmill Creek to mouth; unknown**

Kinnikinic Creek below Sawmill Creek has historically been affected by the proximity of tailings from the Clayton silver mine. Sediment and metals may have been a problem based on the erosional nature and position of those deposits in relation to the stream channel. Restoration activities have been completed to stabilize these tailings piles which were subject to substantial wind and water erosion. The stream channel has been reconstructed to move the creek away from the tailings and to prevent further contact. This activity has been shown to reduce metals loading to levels that comply with state water quality standards. An implementation monitoring plan has been developed as part of the remedial activities and will serve to track BMP effectiveness. BURP monitoring will continue to show beneficial use support status or the need for further implementation.

**Lost Creek, headwaters to sink; unknown**

Very little is known about the condition of Lost Creek. One BURP site at very low flow (less than 1 cfs) may have been insufficient to characterize the quality of this stream. The source of Lost Creek is a spring that may have geothermal features with less than 1 cfs flow. Lost Creek creates a palustrine emergent wetland above the Valley Road and the outlet is through a road culvert at the road crossing. The flow from Lost Creek infiltrates into alluvium within a mile of crossing the Valley Road. It does not make its confluence with the Salmon River. Due to its small watershed area it does not experience a hydrologic peak that allows for a significant increase in flow above its base flow. Follow up flow measurement during peak runoff of area streams showed flow in Lost Creek much below 1 cfs (0.06 cfs). Lost Creek will be removed from the §303(d) list as it was listed in error. A TMDL for Lost Creek is not warranted.

**Salmon River, Hell Roaring Creek to Redfish Lake Creek; sediment**

Some sections of the upper Salmon River have reduced streambank stability (<80% stable banks) associated with ice scouring on private ground. This condition may have

been exacerbated by historic grazing practices, however improvements in grazing management have been made that have improved the potential for recovery. Depth fines measured at two locations were elevated above targets for wadable streams (40-50%). Stream bank erosion rates have been quantified for several locations along the river that show slight to low-moderate streambank erosion. The Salmon River increases its flow and width to depth ratio upstream of the listed reach and falls into the assessment category of Large River BURP over the listed reach. Fisheries data show that the listed reach is in full support of beneficial uses. A TMDL for the Upper Salmon River reach from Hell Roaring Creek to Redfish Lake Creek is not warranted at this time.

#### **Salmon River, Redfish Lake Creek to EF Salmon River; sediment, temperature**

Available data suggests that there is not a temperature problem in the Salmon River. Maximum water temperatures did not exceed 20°C in the few measurements reported. It is not known if spawning temperatures are exceeded or even applicable, although early (before 1984) USGS data shows September temperatures were often below 13°C. Large river BURP and wadable stream BURP sites on the Salmon River throughout the subbasin show aquatic life uses fully supported. No current information is available on sediment loading to the Salmon River over this reach. Sediment inputs over this reach do not appear to be impairing beneficial uses. Greater stream energy to transport sediment and armoring of the streambank along Highway 75, make it unlikely that sediment sources along the Salmon River are limiting beneficial uses. Fisheries data show that this reach of the Salmon River is in full support of aquatic life beneficial uses and a TMDL for this reach is not warranted.

#### **Squaw Creek, headwaters to mouth; temperature (EPA new addition)**

Macroinvertebrate data show no signs of temperature impacts at BURP sites on Squaw Creek. Thermograph data show that the stream can reach maximum temperatures near 18°C in lower reaches in the summer time. However, the stream meets state standards for cold water biota and salmonid spawning. The state's bull trout criterion of 12°C as a daily average was exceeded by 1.5° during the summer. The federal standard of 10°C as a 7-day moving average of daily maximums was considerably exceeded in much of Squaw Creek. The BLM and Salmon-Challis National Forest target temperature of 15°C for bull trout streams in the summer was exceeded as much as three degrees in lower reaches and one degree in middle reaches. Further evaluation of the potential for geothermal influence is warranted. Squaw Creek will be further evaluated for temperature criteria exceedances. A temperature TMDL may not be appropriate for Squaw Creek and will not be developed at this time pending further evaluation of conditions that influence the observed temperature regime.

#### **Challis Creek TMDL**

##### **Loading Capacities and Targets**

The current state of science does not allow specification of a sediment load or load capacity to meet the narrative criteria for sediment and to fully support beneficial uses for coldwater biota and salmonid spawning. All that can be said is that the load capacity lies somewhere between current loading and levels that relate to natural stream bank erosion

levels. We presume that beneficial uses were or would be fully supported at natural background sediment loading rates that are assumed to equate to the 80% bank stability regimes required to meet state water quality standards.

Beneficial uses may be fully supported at higher rates of sediment loading. The strategy is to establish a declining trend in sediment load indicator targets, and to regularly monitor water quality and beneficial use support status. If it is established that full support of beneficial uses is achieved at intermediate sediment loads above natural background levels, and that narrative sediment standards are being met the TMDL will be revised accordingly.

### **Sediment Target**

To improve the quality of spawning substrate and rearing habitat in Challis Creek, it is necessary to reduce the component of subsurface fine sediment less than 6.35 mm to below 28%. Reducing stream bank erosion to a rate associated with 80% stream bank stability could effect this.

## **Loading Summary**

### **Existing Sediment Sources**

The primary source of sediment to Challis Creek has been identified as stream bank and road erosion. The DEQ conducted stream bank erosion inventories from approximately 1 mile above the confluence of Lodgepole Creek to 1 mile above the confluence with the Salmon River to estimate the amount of sediment loading to Challis Creek from stream bank and road erosion. Erosion inventory reaches are shown in Figure 8 a and 8b.

Historic overgrazing has dramatically changed the character of streambank vegetation creating the potential for accelerated stream bank erosion. Riparian management has been implemented in some areas resulting in improved conditions over limited areas, though increased stream bank erosion from livestock use within the riparian vegetation zone remains a significant source of sediment to Challis Creek. The stream bank erosion inventory conducted on Challis Creek shows that the primary source of sediment from stream bank erosion occurs over the upper and lower evaluation reaches. Stream bank erosion over the upper-middle reach is also significant, though occurring at a lower rate, particularly because of the lower gradient of the river over this reach. The upper segment may have been historically impacted by periodic heavy releases of water from Mosquito Flat Reservoir and/or downcutting from the road culvert. This condition, combined with grazing impacts, is often exacerbated by diversion of water for irrigation, which reduces the streams capacity to move sediment. During periods of peak flow the sediment from the upper reach that accumulates is transported and deposited along lower gradient reaches with

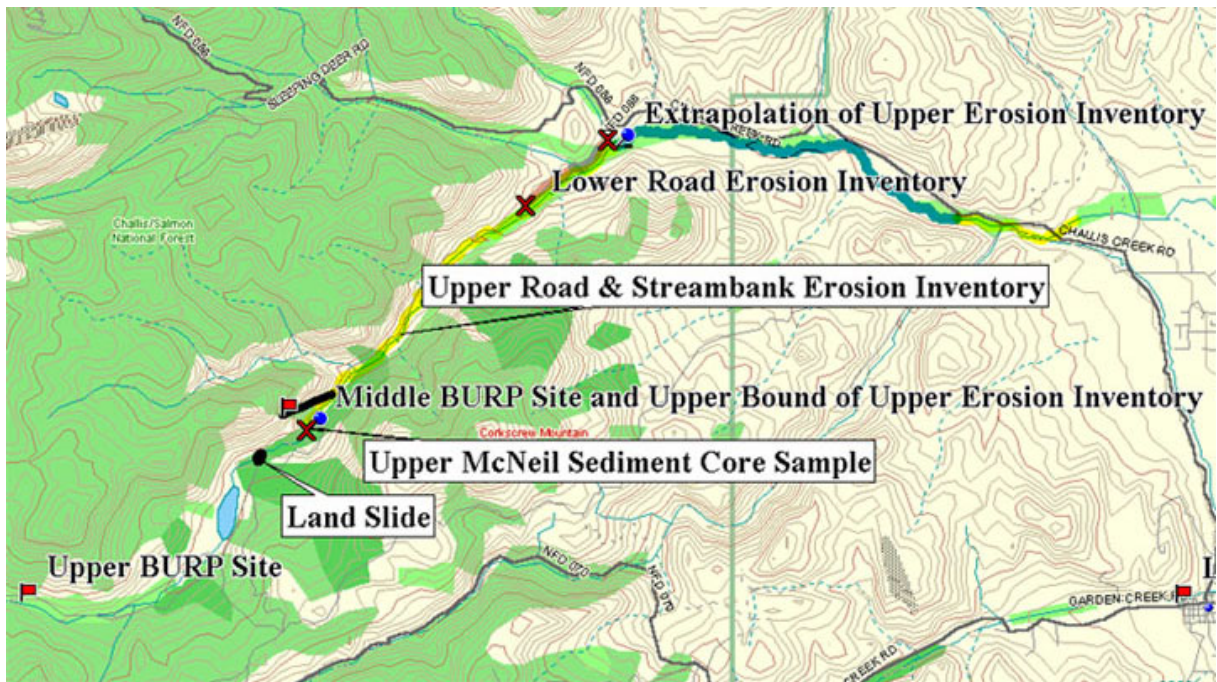


Figure 8a. Upper Challis Creek sample locations below Mosquito Flat Reservoir.

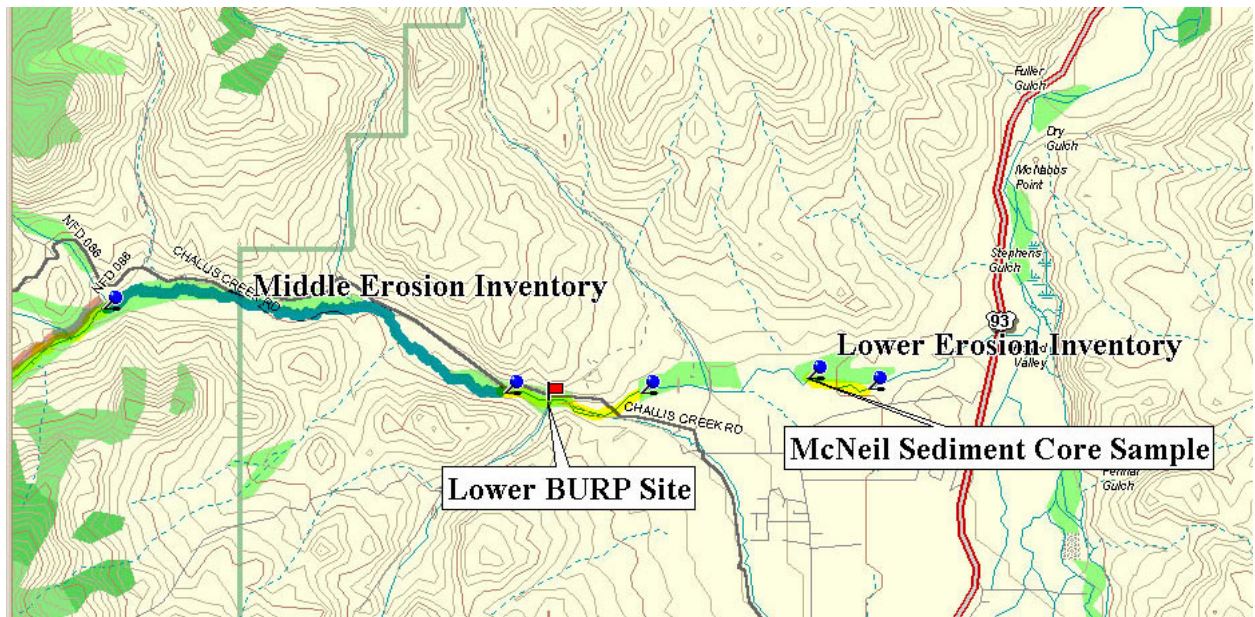


Figure 8b. Lower Challis Creek sample locations below Mill Creek.

reduced flow. The erosive action of high water on unstable stream banks during peak flow also acts to increase erosion and transport of sediment to depositional reaches.

Reduction of stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density, vigor and structure to armor stream banks, reduce lateral recession, trap sediment and reduce the erosive energy of the stream thus reducing sediment loading. In reaches that are down-cut, or that have vertical erosive banks, continued erosion would be necessary to re-establish a functional flood plain that

would subsequently be colonized with stabilizing riparian vegetation. This process could take many years. It is also expected that improvement of riparian vegetation density and structure would reduce the potential for temperature and bacteria loading in the future.

### **Estimates of Existing Load**

Based on estimates from stream bank and road erosion inventories on Challis Creek the existing accumulated stream bank erosion rate for the 4 inventory reaches including extrapolated reaches and 2 road erosion inventory reaches over the current 303(d) listed segment is 816 tons per year. The inventory reaches are distributed from 1 mile above the confluence of Lodgepole Creek to approximately 1 mile above the confluence with the Salmon River.

### **Waste Load Allocation**

There are no permitted point source discharges in the Challis Creek watershed.

### **Load Allocation**

Using water quality targets identified in this TMDL sediment load allocations and sediment load reductions are outlined in this section. Because the primary chronic source of sediment loading to Challis Creek is stream bank erosion and surface erosion from the Challis Creek Road above Eddy Creek, quantitative allocations have been developed. These sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment (<6.35 mm indiameter) in areas suitable for salmonid spawning. Stream bank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Stream bank erosion load allocation is based upon the assumption that natural background sediment production from stream banks equates to 80% stream bank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition stream bank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic and sedimentary geology types. Based on the existing sediment load from stream bank and road erosion on Challis Creek an overall reduction of 36% is recommended. Individual load reductions by reach range from 49% to 0%. Challis Creek stream bank and road erosion load allocations are broken down by individual inventory segment in Table 21. Appendix F contains stream bank erosion inventory data for each of the inventory reaches as well as maps.

### **Margin of Safety**

The Margin of Safety (MOS) factored into load allocations for Challis Creek is implicit. The MOS includes the conservative assumptions used to develop existing sediment loads. Conservative assumptions made as part of the sediment loading analysis include: 1) desired bank erosion rates are representative of assumed natural background conditions; 2) water quality targets for percent depth fines are consistent with values measured and

set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production.

**Table 24. Sediment load allocations/reductions by erosion inventory reach.**

<b>Reach Number (from downstream to upstream)</b>	<b>Existing Erosion Rate (t/mi/y)</b>	<b>Total Erosion Rate (t/y)</b>	<b>Proposed Erosion Rate (t/mi/y)</b>	<b>Load Allocations (t/y)</b>	<b>Erosion Rate Percent Reduction</b>	<b>Percent of Total Erosion</b>
Landslide	N/A	195	N/A	146	25	19
Upper	71	318	36	159	49	31
3 (Upper Middle)	10	46	6	28.5	40	5
2 (Middle)	5	6	6	8	0	<1
1 (Lower)	96	422	71	313	26	42
5 Road	9	24	5	14	44	2
<b>Totals</b>	<b>-----</b>	<b>1011</b>		<b>668</b>	<b>34</b>	<b>100</b>

### **Seasonal Variation and Critical Time Periods of Sediment Loading**

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. This sediment analysis characterizes sediment loads using average annual rates determined from empirical characteristics that developed over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame; however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

Annual erosion and sediment delivery are functions of a climate where wet water years typically produce the highest sediment loads. Additionally, the annual average sediment load is not distributed equally throughout the year. Erosion typically occurs during a few critical months. For example, in the Challis Creek watershed, most stream bank and road erosion occurs during spring runoff.

This sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example stream bank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event. Finally, it is assumed that the accumulation of sediment within dry channels is continuous until flow resumes and the accumulated sediment is transported and deposited.

### **Public Participation**

The Challis Experimental Stewardship Group is the approved Watershed Advisory Group for the Upper Salmon and Pahsimeroi watersheds. The Challis Experimental Stewardship